



Sustainable and Safe Process and Product Development supported by Risk Assessment and Life Cycle Assessment

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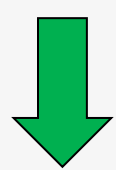
A-17: Sustainable and Safe Process and Product Development supported by Risk Assessment and Life Cycle Assessment

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The purpose of combining Risk and Life Cycle Assessments

The development and application of **modern biomaterials** is regarded as a **sustainable alternatives** in a wide range of applications within the built environment. They may provide essential sustainable improvements to reduce the green house emissions, e.g. when applied in houses in form of excellent isolation materials. They may though be provide an **increasing risk as they are inherently flammable**.



Both the aspects of “safety” & “sustainability” have to fulfilled in a new product based on biomaterials

Therefore, flame retardants have to be applied improving (fire) safety, but often on the cost of a reduced sustainability.

WHY to include such a support ?

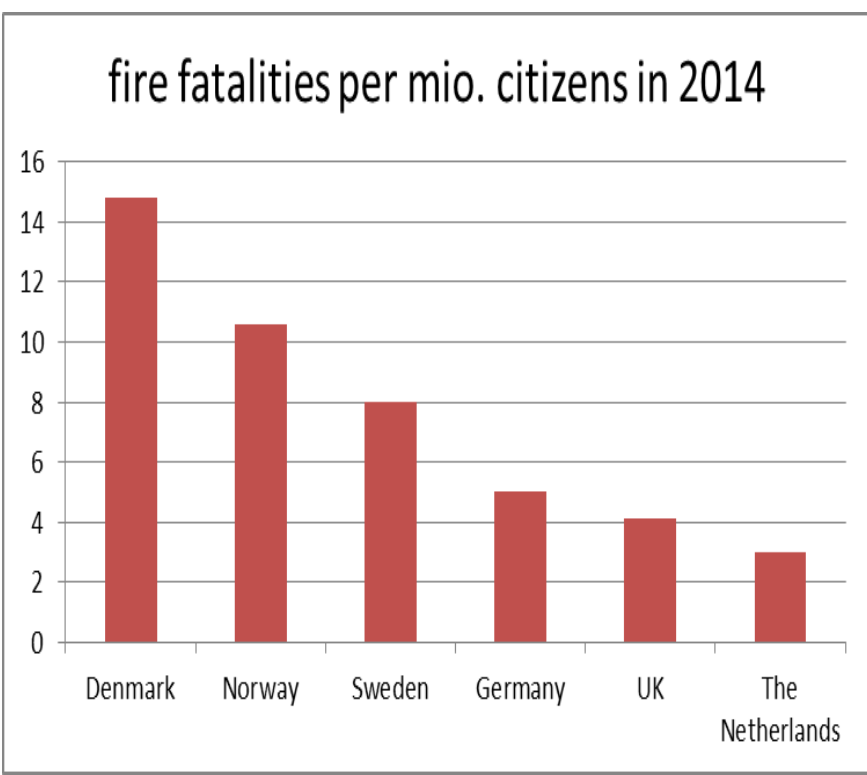
Risk Assessment and Life Cycle Assessment are used as design tools to assess environmental impacts, health and safety aspects of the new technologies and of the products to be developed.

New processes and technology should be at least as safe and reliable as the processes and products being replaced.

- It should not provide a higher risk to workers and the society compared to established processes and products. Safety needs to be evaluated in terms of occupational safety, human health, and environmental exposure.

New products need to be safe for consumers and harmless to the environment. Transport and waste treatment of the coating materials and final products should be managed. Different scientific studies advise using Risk Assessment and Life Cycle Assessment to support decision making on e.g. nanotechnology, including nano-based flame retardant solutions.

Safety of biomaterials is important !



- In Denmark:
- 80 persons dies in a fire each year which has been a very constant number over decades
 - 1500 persons are hospitalized each year
 - A fire is damaging the environment
 - fire emissions to air and water ,
 - lost resources
 - fire fighting water

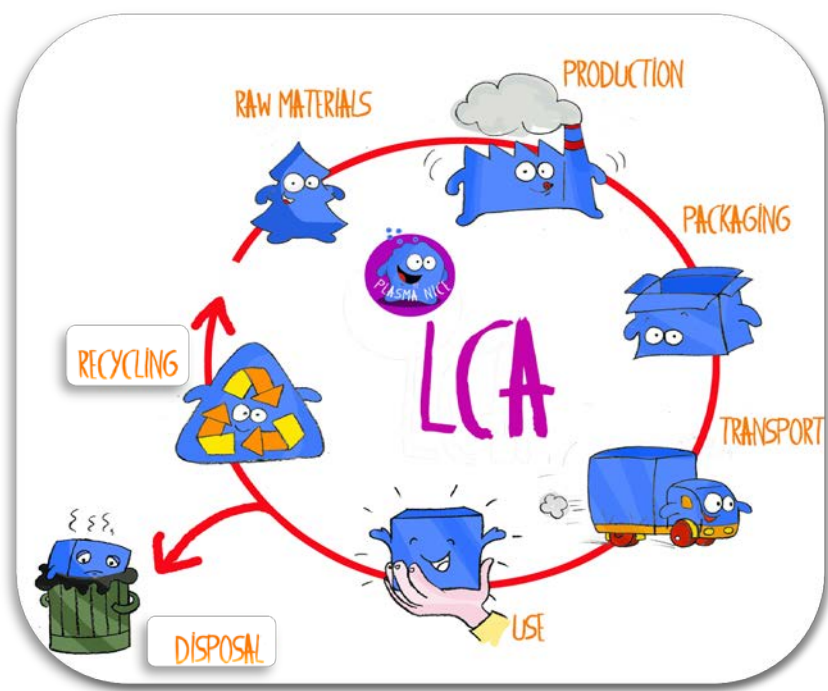
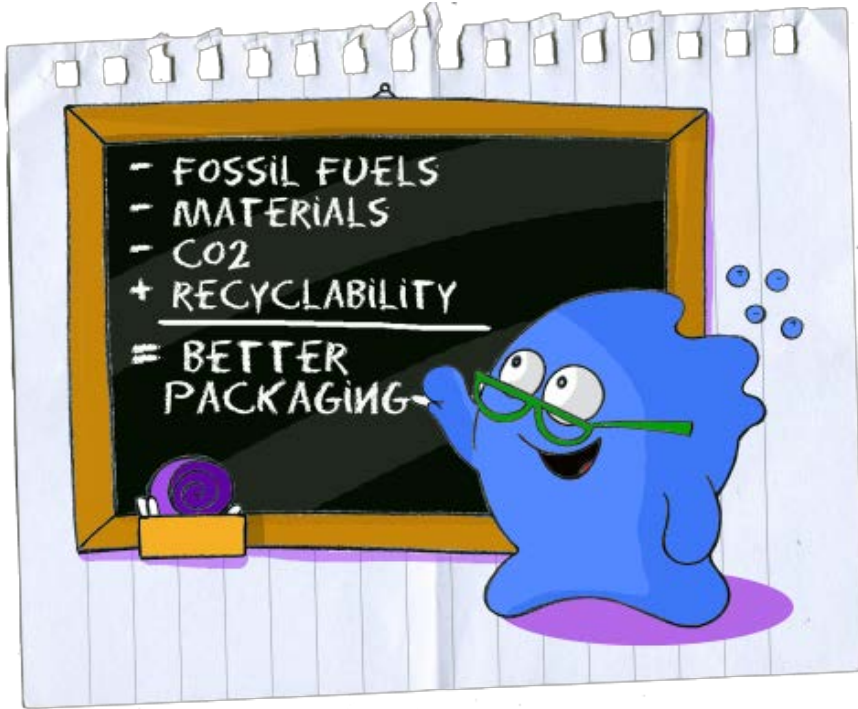
The **Danish society loose annually 2.7 billion DKK caused by fires**,
• not including societal costs in form of traffic, electricity and communication disturbances , as well as expences for hospatilisation and lost working ability, etc..

Lit.: DBI newsletter December 2015 and fire strategy report (in Danish):
http://www.dbi-net.dk/files/pdf/Brandsikkert_Danmark_9.dec.2015+.pdf

Methods

Various commonly used methods including Risk Assessment and Life Cycle Assessments can be applied as e.g. FMEA, HazOp, Consequence calculations, standard databases as well as Precautionary Matrix to assess safety, health and environmental impacts of e.g. flame retardants and nanomaterials.

Using a life cycle approach a holistic assessment of the technology is possible. The methodology has been applied in several EU projects , as in the EU PlasmaNice project on susatinable and safe paper coatings.



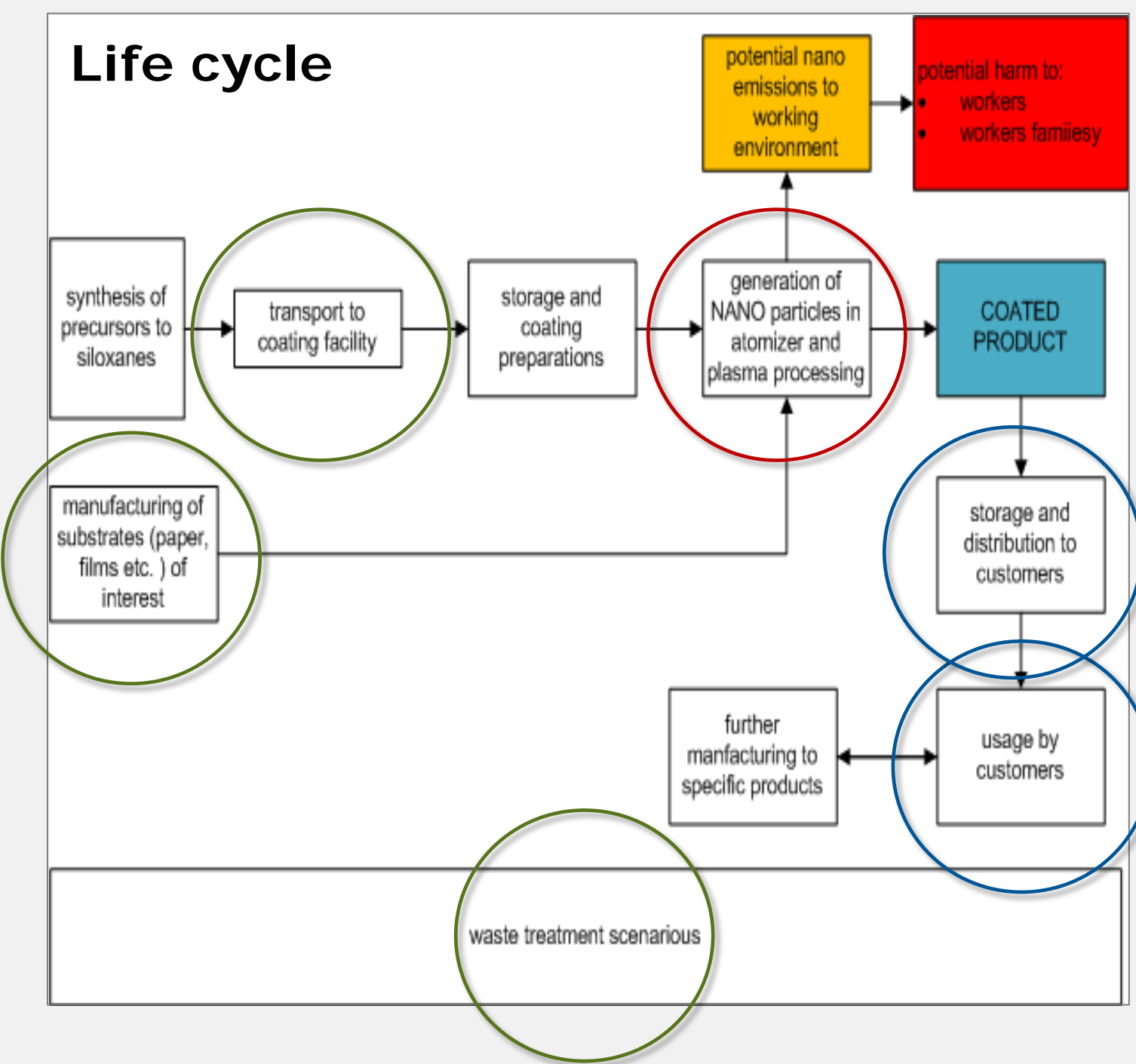
Results

The sustainability of the overall process and products can be evaluated in a holistic perspective combining safety, environmental, health and also cost assessments.

The perspectives of occupational health, consumer safety and waste treatment perspective may be assessed with focus on safe application of biomaterials, flame retardants incl. nanotechnology. Potential sources of exposure to e.g. released flame retardants & nanoparticles may be identified

- Occupational exposures
- Environmental exposures: accidents/spills in manufacture; transport; waste treatment of e.g. coating material
- Emissions under emergencies

Life cycle



Potential exposures

- **Workers**
- **Environment**
- **Consumers**

Conclusions

The development of new biomaterials and respective additives and coating materials may be supported using a holistic approach combining safety assessment, environmental evaluations using Life cycle analysis as well as a cost assessment. The methods and databases aplied are commonly known and widely acknowledged.

The methods together provide a holistic view on the sustainability of new biomaterials and process developments in a qualitative and quantitative way. By that these combination of methodologies provides a common basis to give feed back to the designers and for communication to all other stakeholders.